



# PIER Energy-Related Environmental Research

Environmental Impacts of Energy Generation, Distribution and Use

## West Coast Regional Carbon Sequestration Partnership: Phase II Geologic Pilots and Continued Characterization

Contract no.	Contractor	Amount* (\$)	Match Funding (\$)	Commission Project Manager	Commission Contract Manager
700-05-002 (WA-1956) <sup>1</sup>	Aspen Environmental	150,624	—	Larry Myer	Chris Tooker
500-05-028 <sup>2</sup>	California Department of Conservation, California Geological Survey	150,000	30,000	—	Larry Myer
500-02-004 (MR-045) <sup>3</sup>	California Institute for Energy and Environment (CIEE)	5,190,587	1,160,000	Larry Myer	Beth Chambers
500-99-013 (BOA-117) <sup>4</sup>	California Institute for Energy and Environment	155,183	—	Guido Franco	Beth Chambers
500-02-014 (WA-122) <sup>5</sup>	Electric Power Research Institute	125,541	—	Guido Franco	Beth Chambers
500-05-030 <sup>6</sup>	Electric Power Research Institute	3,654,915	903,000	—	Larry Myer
<b>Total Amount</b>		<b>9,426,850</b>	<b>2,093,000</b>		

\*Aspen and CIEE amounts are part of larger WESTCARB Phase II agreements: WA-1956 total = \$177,529; MR-045 total = \$10,071,422; BOA-117 total = \$518,925

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**Project Term:** 2006–2009

### The Issue

Reducing human-made carbon dioxide (CO<sub>2</sub>) emissions is a complex challenge requiring multiple solutions; one near-term solution is carbon capture and geologic sequestration (CCS). CCS refers to “capturing” CO<sub>2</sub> before it is released into the atmosphere and storing it out of contact with the atmosphere. It allows society to reduce the carbon intensity of the economy<sup>1</sup> while continuing use of economical fossil fuels, thereby “buying time” to develop and construct affordable non-CO<sub>2</sub>-emitting energy systems. Because the magnitude of investment required to replace the current energy infrastructure is immense, it is critical to validate sequestration technologies for scale-up and deployment within the current infrastructure.

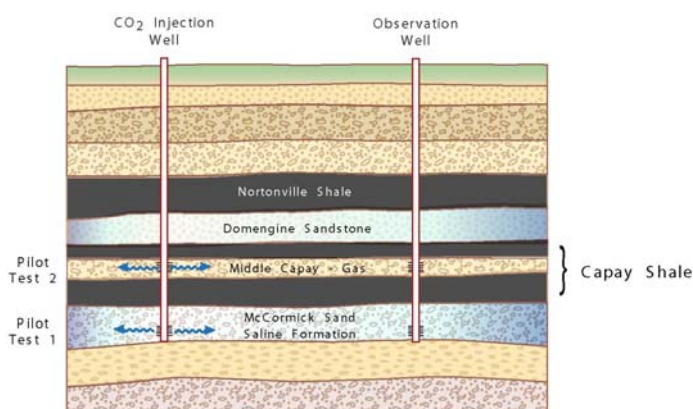
The West Coast Regional Carbon Sequestration Partnership (WESTCARB) is one of seven partnerships that have been established by the U.S. Department of Energy (DOE) to evaluate CCS technologies best suited for different regions of the country. WESTCARB’s region includes

<sup>1</sup> Carbon intensity is the amount of carbon emitted per unit of energy consumed.

California, Alaska, Arizona, British Columbia, Nevada, Oregon, and Washington. WESTCARB's successful Phase I CCS research evaluated regional opportunities and potential barriers to implementation of the technology. The logical next step in validating the feasibility of CCS projects is to perform a more detailed and complex regional analysis of CCS opportunities and their associated costs, and to perform pilot-scale projects to demonstrate their effectiveness in sequestering carbon, verify the capabilities of available monitoring techniques, and provide experience with permitting and public outreach.

### Project Description

WESTCARB's Phase II research will build on the regional characterization work begun in Phase I (2004–2005) and utilize Phase I research results to perform three geological sequestration field validation pilots at which CO<sub>2</sub> injection will take place—two in California's Central Valley and one in northern Arizona. Phase II research also includes detailed site-characterization pilots—one on coal-bed methane and saline formations near a coal-fired power plant in Centralia, Washington, and the other on saline formations and oil fields near Bakersfield, California. Field work performed in the field validation pilots is key to advancing CCS commercialization.



Schematic cross section of the gas and saline formations into which up to 2,000 metric tons of CO<sub>2</sub> (each formation) will be injected in the Rosetta Resources CO<sub>2</sub> Storage Project—the first of WESTCARB's two geologic CO<sub>2</sub> injection pilot projects. The Rosetta Resources CO<sub>2</sub> Storage Project will be located in south Sacramento County, California

Phase II geologic pilot and regional characterization research will address the following key issues affecting deployment of carbon capture and storage technologies in the WESTCARB region:

- Enhancing the methodology for determining and costing logical pathways for transporting CO<sub>2</sub> to appropriate geological sinks.
- Evaluating theoretical locations for new power plants considering location-specific CCS costs, as well as traditional factors for WESTCARB states in the contiguous United States for the purpose of refining estimates of overall WESTCARB regional costs for CCS.
- Identifying opportunities for regional CCS cost reduction through emerging CO<sub>2</sub> capture technologies.
- Validating CO<sub>2</sub> injectability and secure storage in the vast depleting oil and/or gas reservoirs and saline formations underlying California's Great Central Valley and the vast saline formations underlying northern Arizona.
- Refining WESTCARB Phase I geologic characterization of promising geologic formations in Arizona, Nevada, Oregon, and Washington.
- Evaluating the potential CO<sub>2</sub> injectivity and storage potential of deep Puget Sound (Washington state) coal seams and other geologic formations near the TransAlta Corporation's Centralia coal-fired power plant, developing a conceptual plan for a pilot

test, and identifying engineering techniques needed to achieve large-scale geologic sequestration in Puget Sound coals.

- Assessing the storage potential and potential for enhanced oil recovery for San Joaquin Valley sediments underlying the Clean Energy Systems prototype 5-megawatt oxygen-fired “rocket engine” power plant at Kimberlina, California.
- Integrating new characterization data into the WESTCARB Geographical Information System (GIS).
- Informing the public and stakeholders groups about CCS through regional meetings and a joint research and education work.

WESTCARB findings are reported via widely used geographic information system data formats ([www.westcarb.org/carbonatlas.htm](http://www.westcarb.org/carbonatlas.htm)). The U.S. Department of Energy has combined WESTCARB results with those from other regional partnerships to create NatCarb, a national carbon atlas ([www.natcarb.org/ims.html](http://www.natcarb.org/ims.html)). WESTCARB research results have also been published in DOE’s *Carbon Sequestration Atlas of the United States and Canada*, available online at [http://www.netl.doe.gov/publications/carbon\\_seq/refshelf.html](http://www.netl.doe.gov/publications/carbon_seq/refshelf.html).

For more information on WESTCARB projects, visit [www.westcarb.org](http://www.westcarb.org).

### **PIER Program Objectives and Anticipated Benefits for California**

This work supports California’s goal to support the most cost-effective and environmentally sound strategies, including consideration of global climate change, as recommended in the Integrated Energy Policy Report (IEPR) 2005, by

- Taking a leadership role in developing technologies that capture and store CO<sub>2</sub>.
- Continuing research performed by the California Climate Change Center in evaluating the economic and ecological consequences of climate change and adaptation and mitigation strategies to preserve and improve quality of life.
- Implementing all strategies identified by the Climate Action Team as needed to meet the governor’s greenhouse gas emission reduction goals, including recommendations developed as part of the 2005 IEPR.
- Participating in public outreach efforts to educate the public and businesses in California on climate change impacts and actions to mitigate emissions and encourage stakeholder participation in the development of programs to meet California’s climate change goals.

This project also addresses California’s Assembly Bill 32 (Nuñez and Pavley), Chapter 488, Statutes of 2006.

### **Final Report**

PIER-EA staff intend to post the final reports on the Energy Commission website in summer 2010 and will list the website link here.

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